Bakker et al. (2017)
Recent work on the impact of mitigation on the projected decline of the AMOC
Key points in the introduction

- IPCC projects AMOC to weaken but has no Greenland melt.
- GrIS is losing mass at high rate & will likely worsen.
- Need GCM ensemble with GrIS melt, uncertainty added.
- Need to project for multiple centuries.

Here’s what they do:
- Here they use AMOCMIP with best GrIS included to AD 2300.
- They use emulator for probabilistic uncertainty for AMOC.
- Aim is (1) to assess impacts of GrIS & mitigation on AMOC.
- and (2) to estimate the likelihood of future AMOC collapse.
9-model ensemble with multimodel mean removed

IPCC model median ~ 15-20% weakening of the AMOC by 2100 under RCP4.5

Max decrease ~ 80%

Model sample space too small to estimate probabilities
An emulator expands the sample space of GCM runs

- Emulator has several key forcing parameters
- Emulator is first tuned to each GCM
- 10 optimal Monte Carlo ‘runs’ produced for each GCM, using varied forcing parameters
- Multimodel mean is removed
Models show varied response to warming

RCP4.5 ➔ Median stabilizes to ~ -30% by 2150
RCP8.5 ➔ Median stabilizes to ~ -80% by 2250
RCP4.5
Median @ -18% by 2100 AD

RCP8.5
Median @ -37% by 2100 AD
Recovery by 2300 AD @ -75%
RCP4.5 ➔ Impact of GrIS melt *minimal*
RCP8.5 ➔ Impact of GrIS melt *considerable*
Results & Conclusions

- Multi-model mean = 16.5 Sv; observed = 17.2 Sv

- RCP4.5 ➔ AMOC stabilizes in 22\textsuperscript{nd} Century, RCP8.5 in 23\textsuperscript{rd}

- Emulator ➔ Stabilization similar, medians @ -18%, -74%

- RCP8.5 ➔ total AMOC collapse \textbf{20\% probable} by 2300 w/o GrIS

- RCP8.5 ➔ total AMOC collapse \textbf{44\% probable} by 2300 with GrIS

- Caution: AMOCMIP neglects solid ice discharge (has melt only)

- Antarctic impact is not included
Florida Current (FC) transport has decreased by ~9% since 2005. Sea level at Miami increases in proportion to the FC decrease.

Some key questions for future models:

- Does the Florida Current vary proportionally to the AMOC?
- Does this decline presage the AMOC downturn? Or is it decadal?
- How does South Florida sea level respond to FC transport decline?
- What fraction of the recent SLR was due to the Florida Current?